

**Merlin Gerin**

**Modicon**

**Square D**

**Telemecanique**

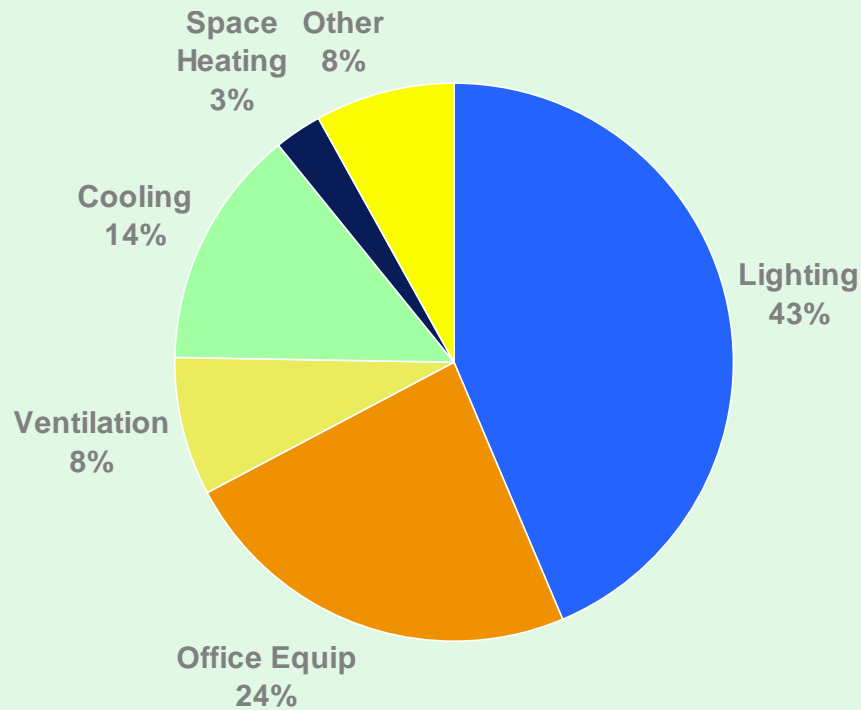
“lighting” control systems



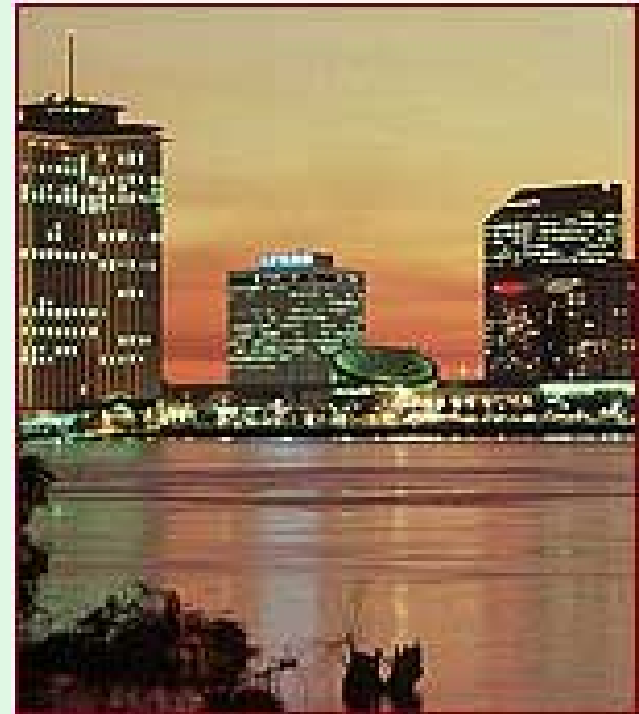
| Report Documentation Page  |                                    |                                     |  | Form Approved<br>OMB No. 0704-0188          |                                    |
|--|------------------------------------|-------------------------------------|--|---|------------------------------------|
| Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. |                                    |                                     |  |   |                                    |
| 1. REPORT DATE<br><b>26 FEB 2004</b>   |                                    | 2. REPORT TYPE<br><b>N/A</b>        |  | 3. DATES COVERED<br><b>-</b>                |                                    |
| 4. TITLE AND SUBTITLE<br><b>Lighting Control Systems</b>   |                                    |                                     |  | 5a. CONTRACT NUMBER                         |                                    |
|  |                                    |                                     |  | 5b. GRANT NUMBER                            |                                    |
|  |                                    |                                     |  | 5c. PROGRAM ELEMENT NUMBER                  |                                    |
| 6. AUTHOR(S)   |                                    |                                     |  | 5d. PROJECT NUMBER                          |                                    |
|  |                                    |                                     |  | 5e. TASK NUMBER                             |                                    |
|  |                                    |                                     |  | 5f. WORK UNIT NUMBER                        |                                    |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)<br><b>Schneider Electric</b>  |                                    |                                     |  | 8. PERFORMING ORGANIZATION<br>REPORT NUMBER |                                    |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)  |                                    |                                     |  | 10. SPONSOR/MONITOR'S ACRONYM(S)            |                                    |
|  |                                    |                                     |  | 11. SPONSOR/MONITOR'S REPORT<br>NUMBER(S)   |                                    |
| 12. DISTRIBUTION/AVAILABILITY STATEMENT<br><b>Approved for public release, distribution unlimited</b>  |                                    |                                     |  |   |                                    |
| 13. SUPPLEMENTARY NOTES<br><b>See also ADM001865, Industrial Process and Energy Optimization. Proceedings of the Industry Workshop Held in Gettysburg, PA, 25-27 February 2004., The original document contains color images.</b>  |                                    |                                     |  |   |                                    |
| 14. ABSTRACT   |                                    |                                     |  |   |                                    |
| 15. SUBJECT TERMS  |                                    |                                     |  |   |                                    |
| 16. SECURITY CLASSIFICATION OF:  |                                    |                                     | 17. LIMITATION OF<br>ABSTRACT<br><b>UU</b> | 18. NUMBER<br>OF PAGES<br><b>42</b>         | 19a. NAME OF<br>RESPONSIBLE PERSON |
| a. REPORT<br><b>unclassified</b>   | b. ABSTRACT<br><b>unclassified</b> | c. THIS PAGE<br><b>unclassified</b> |  |   |                                    |

# Why focus on lighting control

Typical energy profile: Office Building



Source: Energy Information Administration, 1995 Commercial Energy Buildings Energy Consumption Survey



***Operational savings from the installation of an intelligent lighting control system frequently exceeds 15% of the total electrical bill.***

# Market Trends

---

- Increasing awareness of energy costs (via Powerlogic or observed)
- Increasing pressure to reduce costs (increasingly limited resources)
  - **Private initiatives to introduce energy savings**
  - **State/Federal laws requiring energy saving technologies**
  - **State/Federal incentives promoting energy saving technologies**

# Product Trends

---

- Increase in microprocessor based control
- Increase in web enabled control (and management software)
- Increase in level of integration between building systems
- Increase in new features, functions, benefits
- Increased ease of installation and maintenance

# Cost of neglecting lighting control

---



**For panels, leaving the lights ON is the same as allowing 10 ovens to operate continuously!!!**


# Savings Calculator

Microsoft Excel - Savings Calculator.xls

File Edit View Insert Format Tools Data Window Help

Arial 10 B I U

A1 =




Procurement made easy - POWERLINK is available on the GSA schedule

**POWERLINK Savings Calculator**

Instructions

Pentagon renovation project - one of many successful POWERLINK government applications



**Lighting Power Consumption**

Calculation Basis:

Square Feet

Calculate 42 kw

**Hours Saved**

Calculated Hours

☒ Demand Curtailment at Peak

Calculate 106 Hours per Month (total saved)

**Luminaire & Facility**

Cost per kWh: \$0.06

Peak Demand Cost per kW: \$ 10.00

Number of Luminaires 350

Calculate Calculated

Lamps per Luminaire 3

Average Lamp Life (hours) 20,000

Cost to Replace Lamp (Labor and Material) \$ 10.00

**System Cost**

Quotation

Calculate \$ 12,000

**Monthly Savings:**

|                  | Money         | Energy                      |
|------------------|---------------|-----------------------------|
| Lighting Energy: | \$ 268        | 4,471 kWh                   |
| Demand Power:    | \$ 421        | 42 kW                       |
| Cooling:         | \$ 40         | 671 kWh                     |
| Relamping:       | \$ 56         | 5,142 kWh (total)           |
| <b>Total:</b>    | <b>\$ 785</b> | <b>Annual \$: 9,419</b>     |
|                  |               | <b>Payback (years): 1.3</b> |
|                  |               | <b>IRR (5 year): 364%</b>   |

Print

This spreadsheet is only a guide to be used in estimating potential savings. Your actual conditions will vary. While reasonable assumptions are made, no guarantee of results is offered or implied.

Ready

start John Berry - All D... Schneider Electric... Microsoft PowerP... Sales Aides Microsoft Excel - ... 99% 2:34 PM

# Intelligent lighting control

---

- Watts over Time
  - **Build on existing energy saving products**
- Growing focus on reducing run-time via Scheduling, Sensing, Switching
- Growing focus on payback
  - **Direct energy cost (with demand)**
  - **Additional maintenance benefits**
  - **Additional life cycle benefits**
  - **Additional HVAC benefits**





# Control Parameters

---

- Basic Control
  - Flexible Scheduling
  - Flexible Switching
- Adaptable Control
  - Demand Control
  - Global Data Sharing
  - Integrate/Interface w/BAS



*Automatically control lighting according to preset schedule, override request, or load shed command.*

# Basic Scheduling

---

- Time and Calendar Events
  - Daily, Weekly, Monthly, Yearly repeating schedule.
  - Automatic daylight savings correction.
  - Sunrise/sunset feature automatically adjust on/off periods to compensate for seasonal changes.
  - Special event/holiday schedules.
- Timer Events
  - RunTime
  - Blink, Dual Blink, Delay



*The special events scheduler allows single events to be programmed in advance.*

# Basic Switching

---



- Inputs provide 'local' override control typically from low voltage wall switches, photo sensors, card access controllers or other control devices.
- Inputs work in conjunction with time schedules to energize circuits, only when lighting is required.

*Inputs can be used to provide timed override control during non-occupied scheduled periods (e.g. weekends)*

# Demand control

---



*An intelligent lighting control can assure non-critical loads are shed during peak-power conditions when utility rates are at their highest.*

- Respond to pre-set energy demand limits.
- Coordinate with on-site generation to assure proper loading for equipment.
- Schedule critical periods based on occupancy requirements.
- Sequence restoration of loads at the end of a demand period.



# Global data sharing

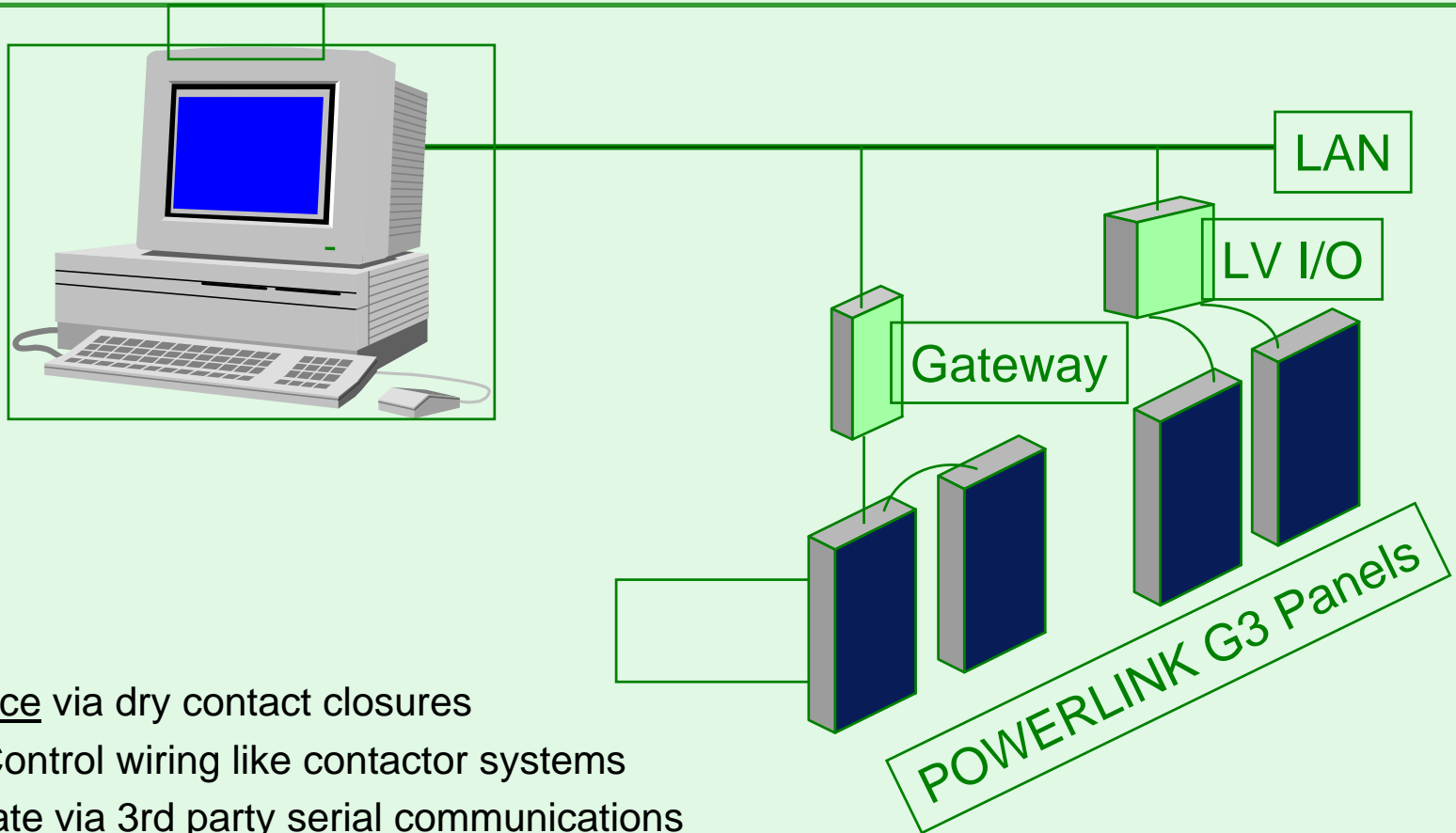
---

- Global data sharing allows one controller to control any breaker or group of breakers connected to the system.
- Eliminates 'hard wire' connections between switching devices by utilizing the local area network (LAN).
- Typical applications include:
  - A single photocell controls every parking lot branch circuit in a large shopping mall.
  - An intrusion alarm switches every branch circuit ON in a large bank.
  - An override panel controls banks of lights at a stadium.



***Global data sharing is ideal for sports arena's, parking lots, egress area's, and convention centers.***

# Integrate/Interface with BAS

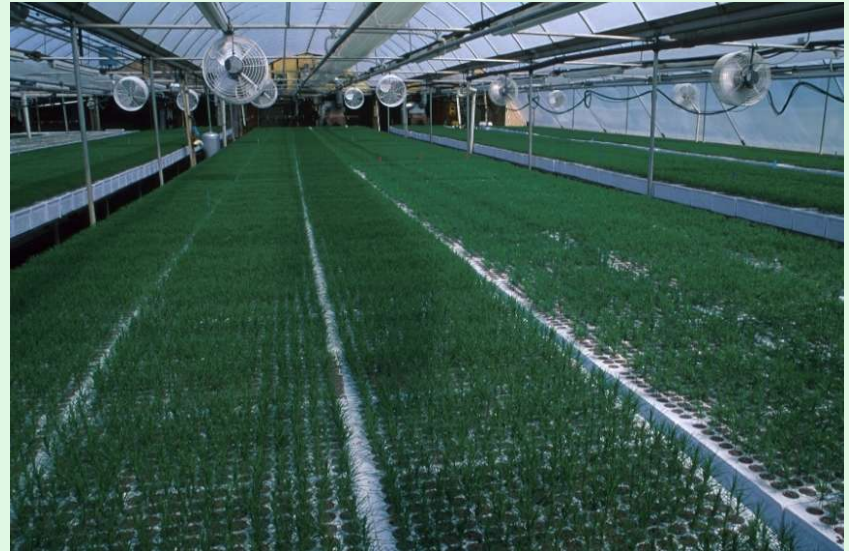


- Interface via dry contact closures
  - Control wiring like contactor systems
- Integrate via 3rd party serial communications
  - Gateway processor communication to POWERLINK G3 Control Module

# Capable of controlling other loads

---

- Other loads can be easily controlled with an intelligent lighting control center
- Applications include:
  - Fans
  - Fractional HP motors
  - Water coolers & heaters
  - Baseboard electric heaters
  - Water pumps



***An intelligent lighting control system provides a low cost alternative to motor control centers when feeding small fractional HP motors and other loads.***

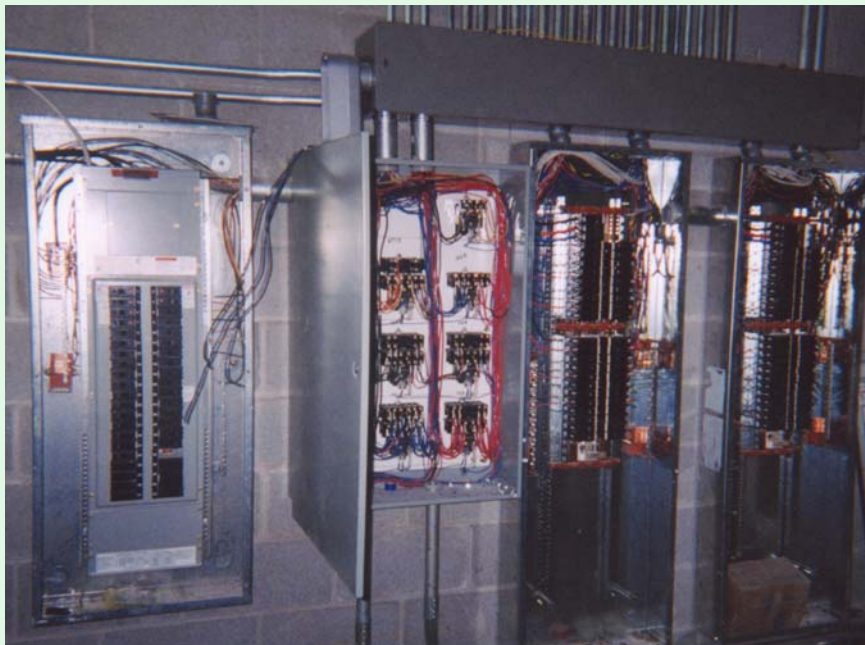
# Controllable Breaker considerations...

- ◆ Compact design utilizes less wall space (sized similar to typical lighting panels); results in reduced installation cost and allows full range of typical panelboard options
- ◆ Limited wiring requirement results in little chance for error and provides easy fix via flexible configuration
- ◆ Fully rated controllable breakers result in code compliant installation
- ◆ Additionally, there are...
  - ◆ Less design time
  - ◆ Powerful control capabilities
  - ◆ Reliable operation
  - ◆ Easy to modify

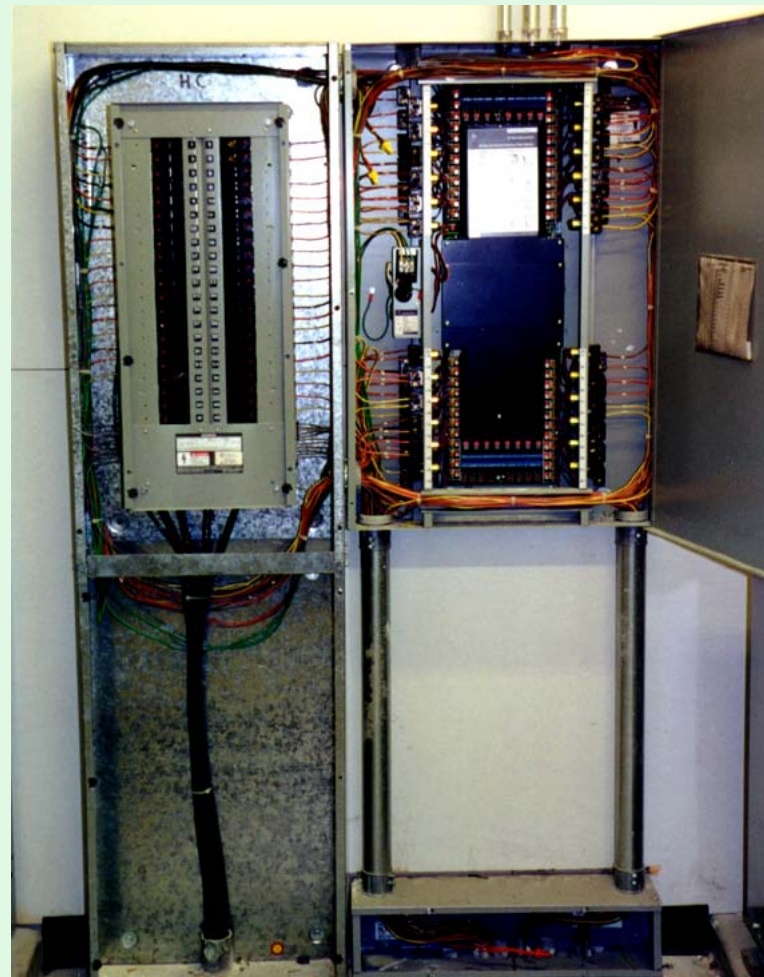




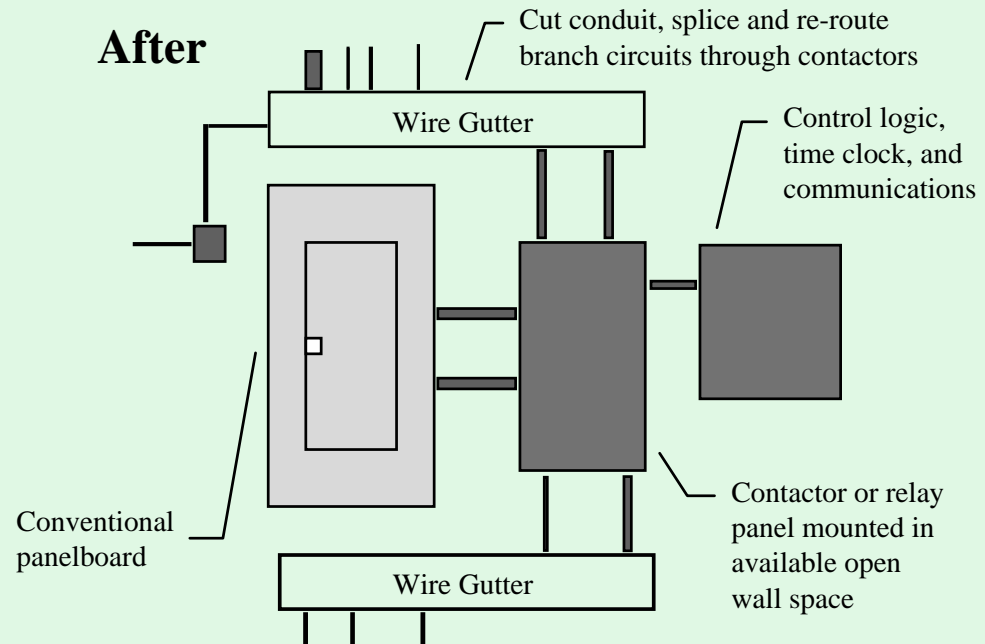
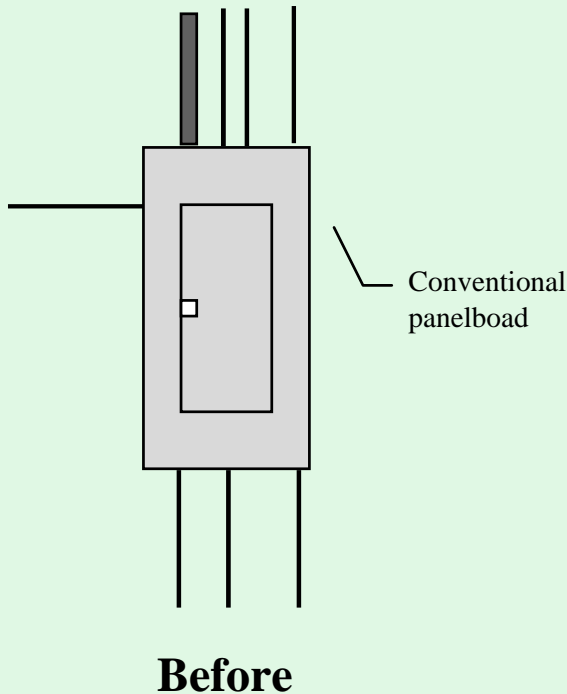
# Traditional Solutions



- Wall Space
- Inter-Wiring
- Code concerns
- Limited versatility
- Maintenance issues



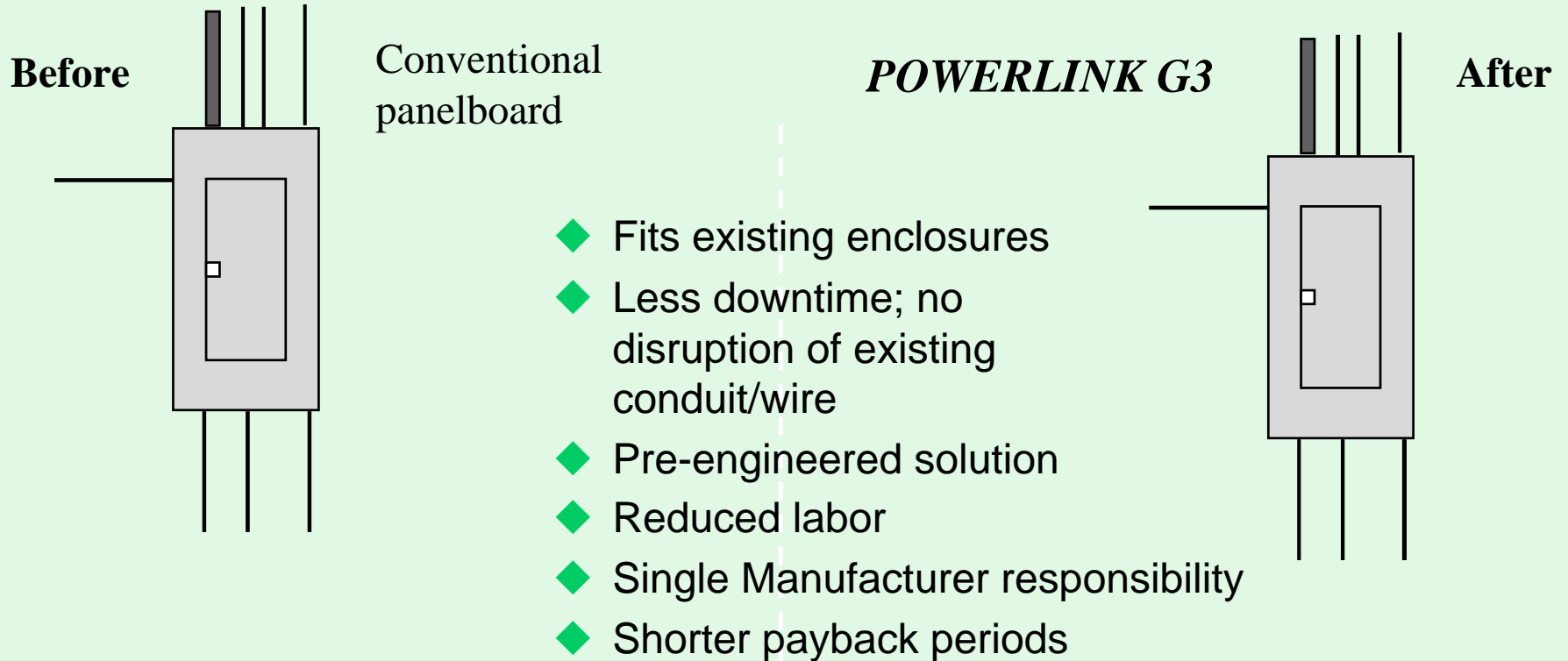
# Traditional Retrofit Solutions



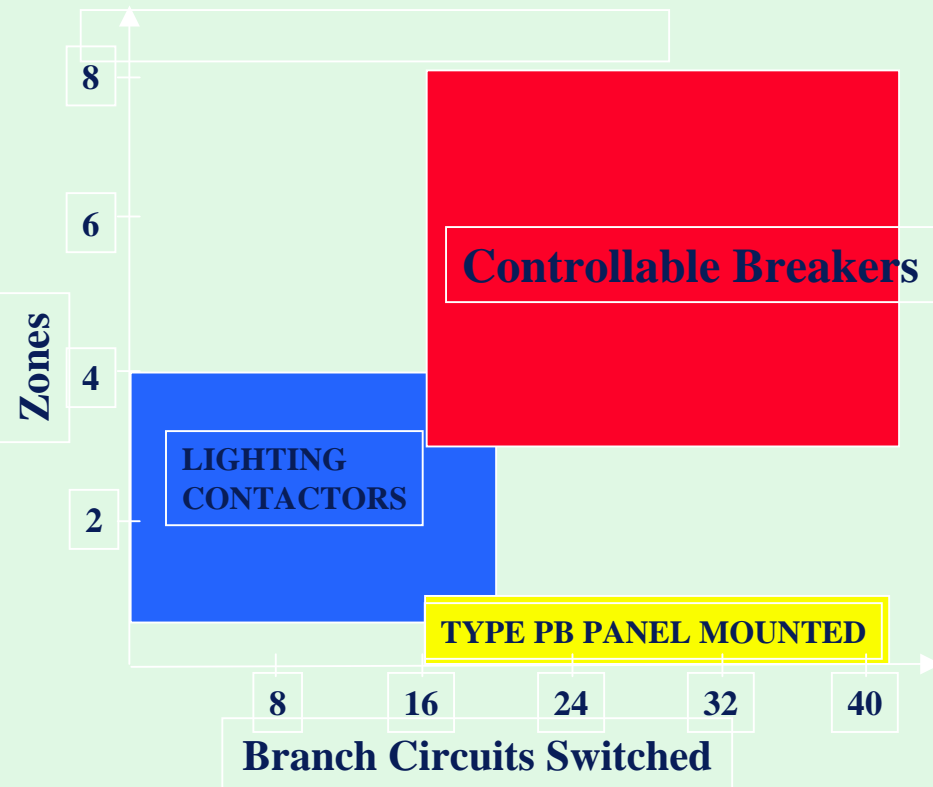
- Additional space required
- Disruption of existing conduits/wire
- No standard design

- Intensive labor requirements
- Multiple manufacturer's products
- Long payback period

# Controllable Breaker Retrofit Solutions



# Cost Benefit of Powerlink

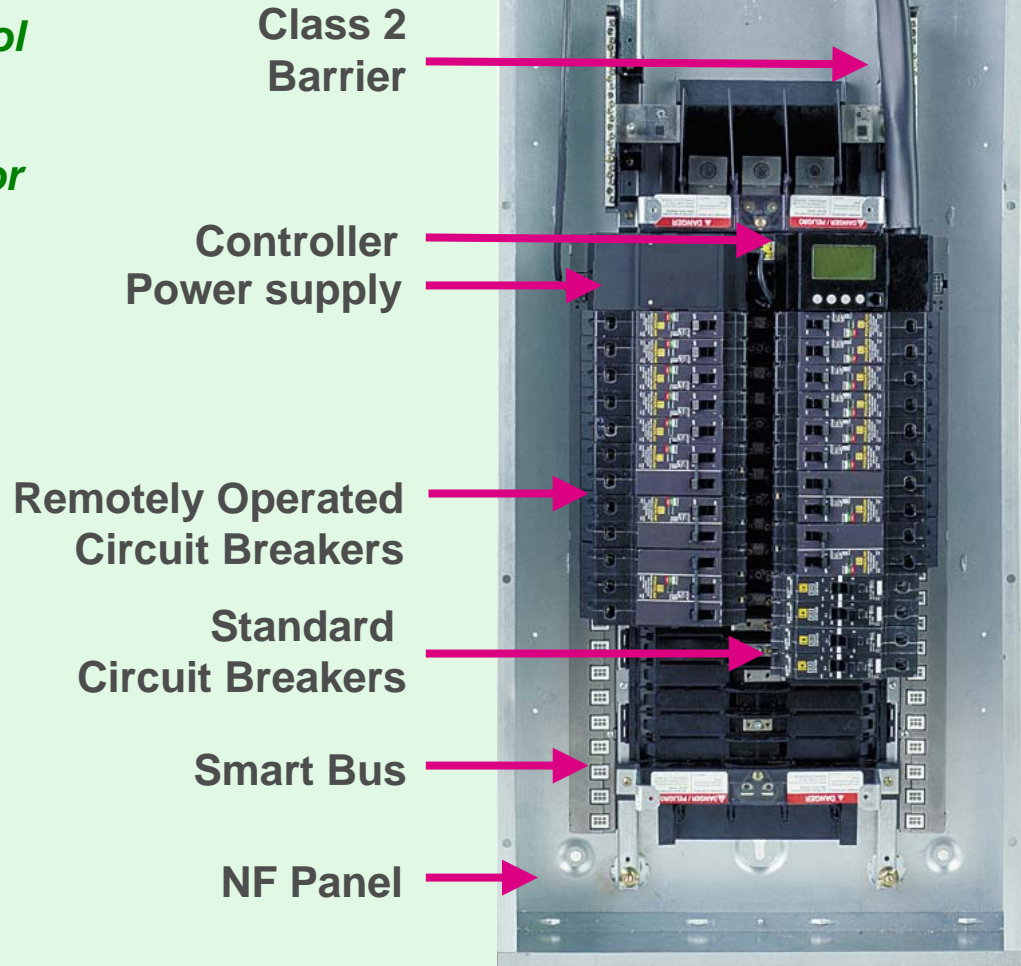


## Rule of Thumb for Powerlink:

- Powerlink becomes more cost effective beyond 16 controlled branch circuits and/or 3 zones.
- Powerlink should be considered for areas w/changing patterns or schedules for occupancy and/or light levels
- Powerlink should be considered for any project with networking and/or time based requirements
- Powerlink should be considered for any retrofit projects.

# Powerlink components

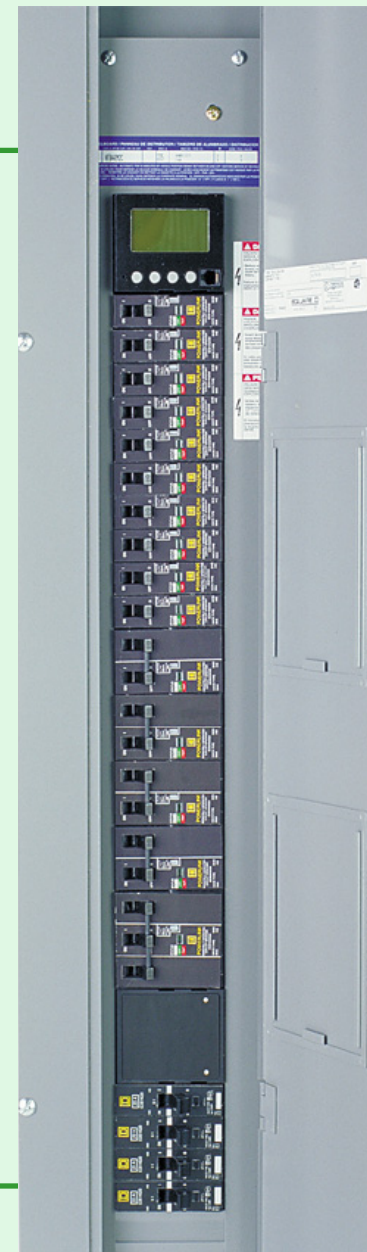
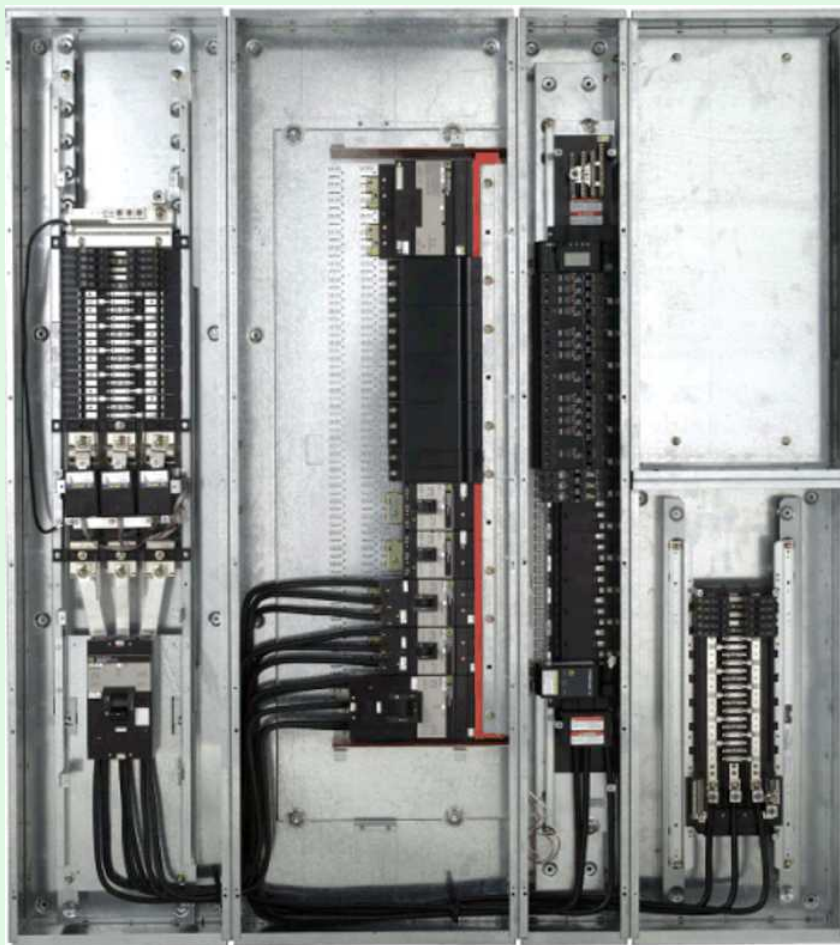
*Powerlink is the only lighting control system that utilizes standard panelboard boxes. Branch wiring and conduits remain undisturbed for retrofit applications.*





# Powerlink Variations

- Standard NF interiors, boxes and covers
- Mains through 600A
- Interior 30, 42, 54 circuit
- Enclosure NEMA 1, 3R, 5 and 12 construction
- Column Wide panels
- Dual-voltage panels
- MPS/IPC
- Wide variety of options (non-linear, tvss, hinged trim, double tub, etc.)



# Powerlink Breaker Design Criteria

---

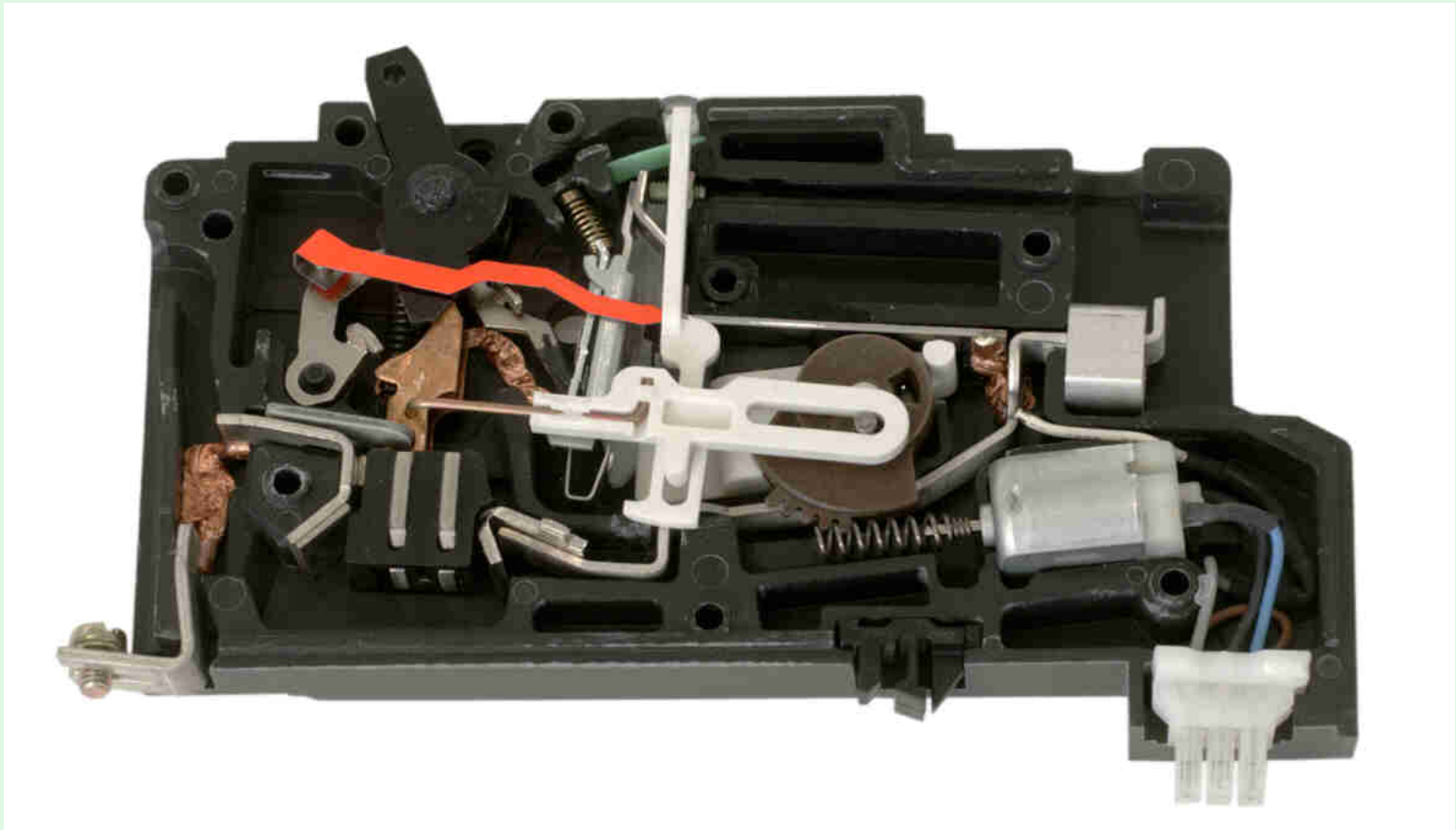


*Powerlink G3 circuit breakers are the only remote switching devices, UL tested and rated for use with many of today's high fault systems.*

- Robust, Reliable design
- UL listed SWD, HID, HACR ratings
- Proven 200,000 cycles.
- Auto/Manual Override
- Mechanical Status Indication
- AIR: 120/208V: 65kA  
277/480V: 14kA
- Series ratings available to 200kA
- Meets NEC 110-10 requirements
- IEC 1000 certified for surge/emissions
- UL listed 50, 67, 916
- High temperature electronics.

# Powerlink Breaker Cutaway View

---





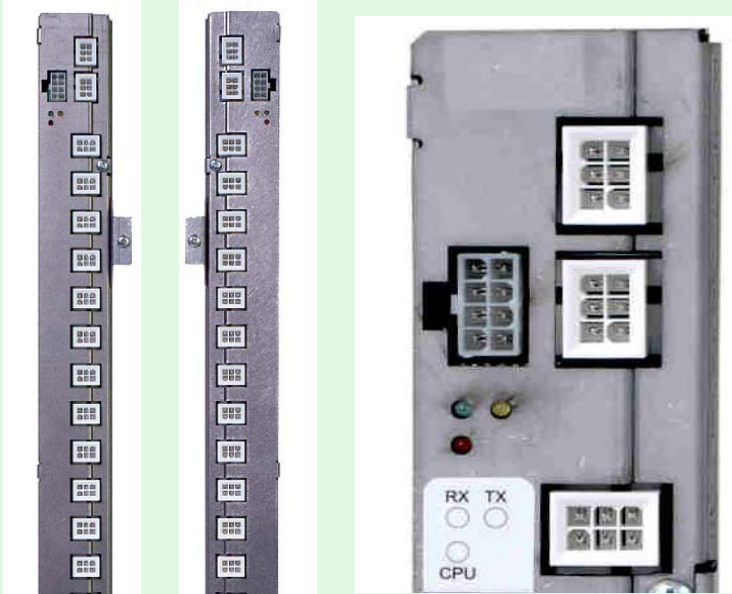
# Powerlink Breaker Series Ratings (240V)

| System Voltage (Maximum) | UL Series Connected Ratings (AIR) | Main           |      | Branch |        |   |
|--------------------------|-----------------------------------|----------------|------|--------|--------|---|
| 240Vac                   | 65,000                            | EGB            | 125A | ECB-G3 | 30A    | 3 |
|                          | 100,000                           | FC             | 100A | ECB-G3 | 15-30A | 1 |
|                          |                                   |                |      |        | 15-30A | 2 |
|                          |                                   |                |      |        | 15-30A | 3 |
|                          |                                   | KC             | 250A | ECB-G3 | 15-30A | 1 |
|                          |                                   |                |      |        | 15-30A | 2 |
|                          |                                   |                |      |        | 15-30A | 3 |
|                          | 200,000                           | IF             | 100A | ECB-G3 | 15-30A | 1 |
|                          |                                   |                |      |        | 15-30A | 2 |
|                          |                                   |                |      |        | 15-30A | 3 |
|                          |                                   | IK             | 250A | ECB-G3 | 15-30A | 1 |
|                          |                                   |                |      |        | 15-30A | 2 |
|                          |                                   |                |      |        | 15-30A | 3 |
|                          | 100,000                           | Class J/T Fuse | 200A | ECB-G3 | 15-30A | 1 |
|                          |                                   |                |      |        | 15-30A | 2 |
|                          |                                   |                |      |        | 15-30A | 3 |

# Powerlink Breaker Series Ratings (480V)

| System Voltage<br>(Maximum) | UL Series<br>Connected<br>Ratings<br>(AIR) | Main              |      | Branch |                            |             |
|-----------------------------|--|-------------------|------|--------|----------------------------|-------------|
| 480Y/<br>277V ac            | 35,000                                     | EG                | 125A | ECB-G3 | 15-30A<br>15-30A<br>15-20A | 1<br>2<br>3 |
|                             | 65,000                                     | FC                | 100A | ECB-G3 | 15-30A<br>15-30A<br>15-20A | 1<br>2<br>3 |
|                             |  | KC                | 250A | ECB-G3 | 15-30A<br>15-30A<br>15-20A | 1<br>2<br>3 |
|                             | 200,000                                    | IF                | 100A | ECB-G3 | 15-30A<br>15-30A<br>15-20A | 1<br>2<br>3 |
|                             |  | IK                | 250A | ECB-G3 | 15-30A<br>15-30A<br>15-20A | 1<br>2<br>3 |
|                             | 100,000                                    | Class J/T<br>Fuse | 200A | ECB-G3 | 15-30A                     | 1           |
|                             |  |                   |      |        | 15-30A                     | 2           |
|                             |  |                   |      |        | 15-20A                     | 3           |

# Powerlink Control Bus and Power Supply



## Control Bus

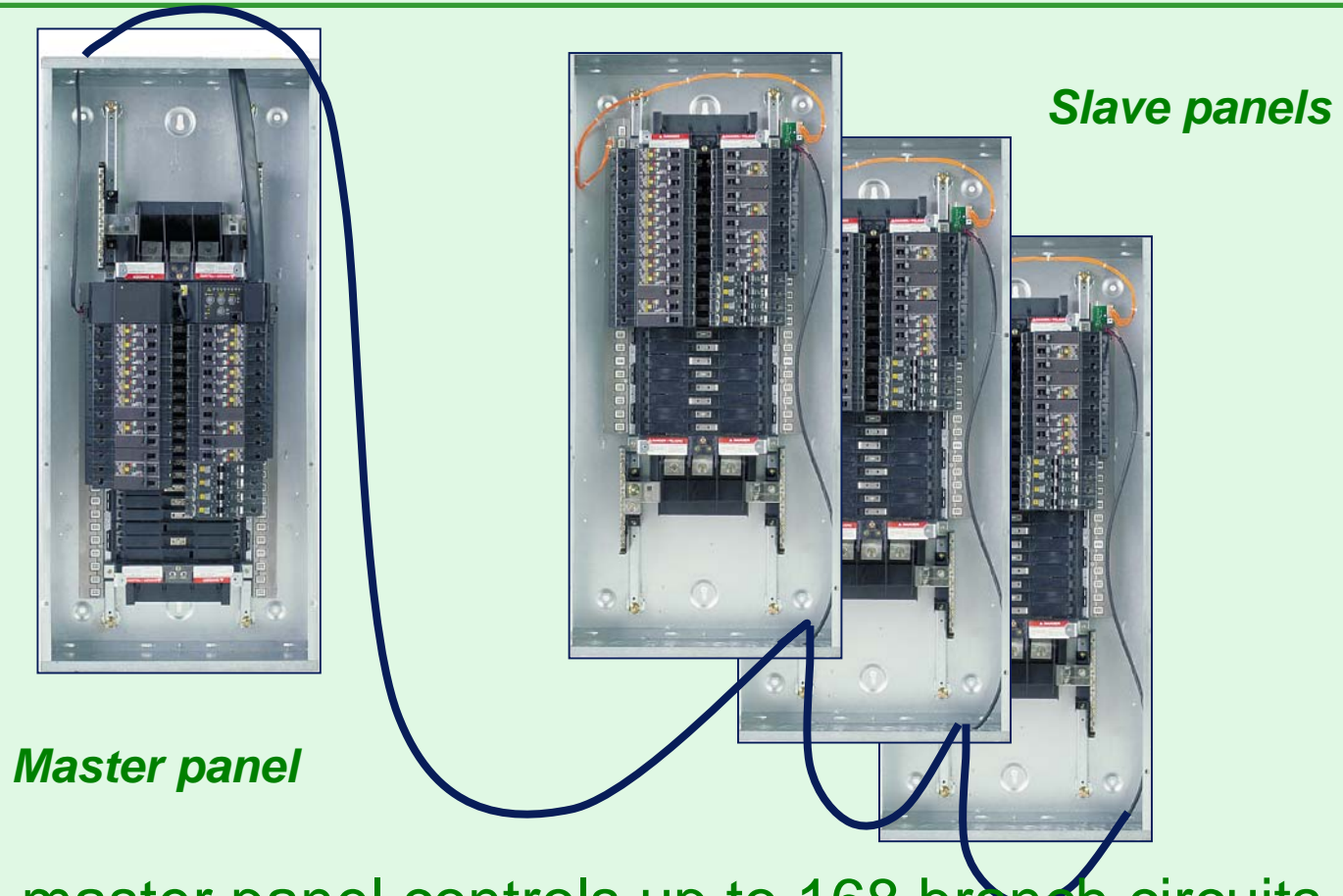
- Distributes commands and monitors breaker/system data
- Attaches directly to NF interior for positive breaker alignment



## Power Supply

- Powers controller & eight control busses
- Protected with integral surge protection

# Powerlink Subnet Design



One master panel controls up to 168 branch circuits in up to eight different panelboards

# Powerlink Controllers

---



## 500 Level System

- Dry-contact I/O interface
- Front keypad
- Remote comm's



## 1000 Level System

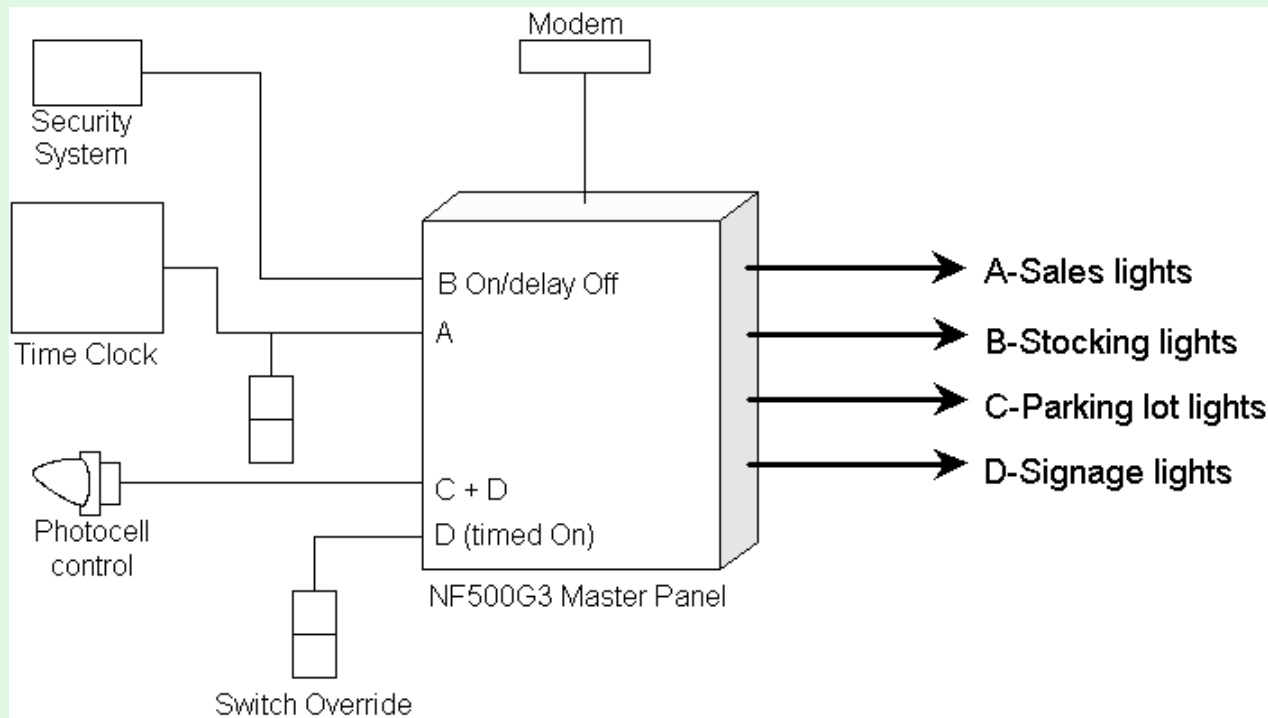
- Same features as 500 level
- Time scheduler
- LCD blacklit display



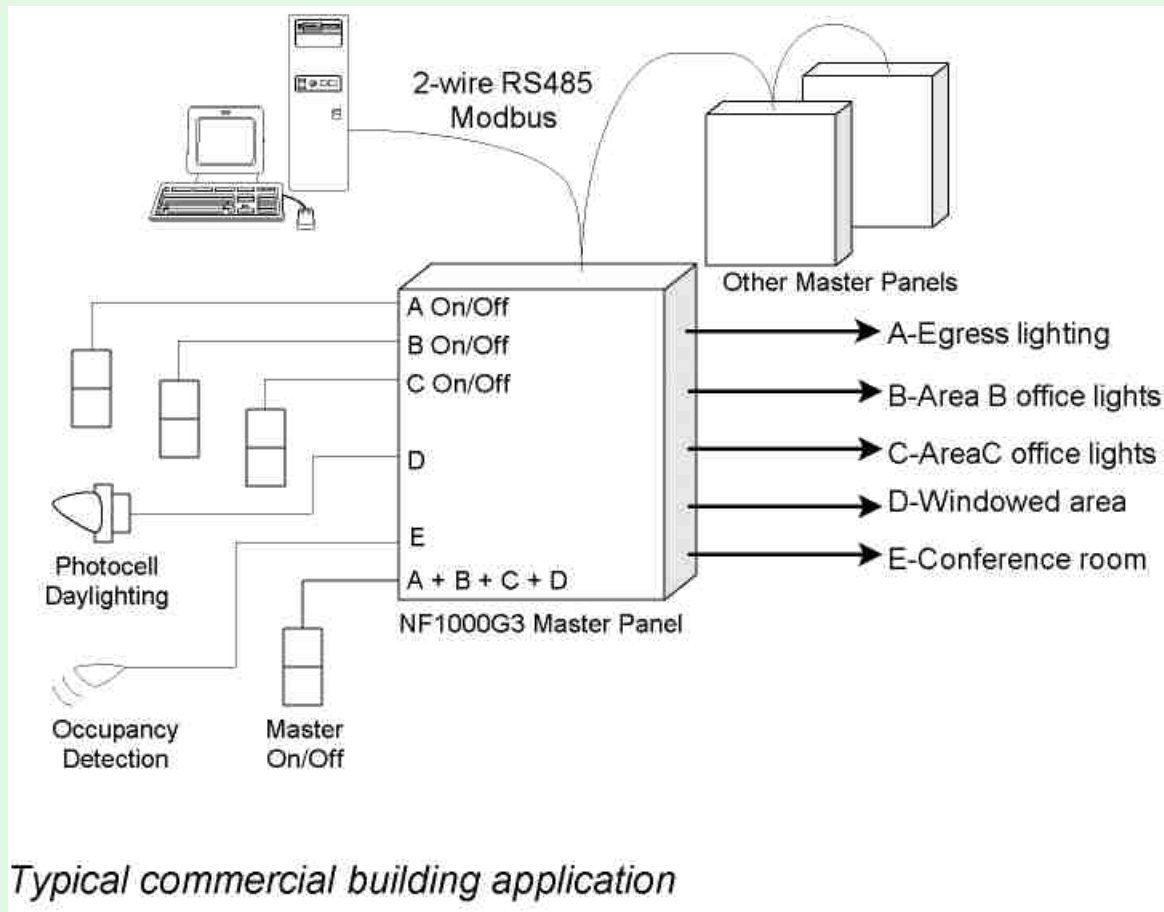
## 2000 Level System

- Same features as 1000
- Global input controller
- Ethernet comm's/Web setup

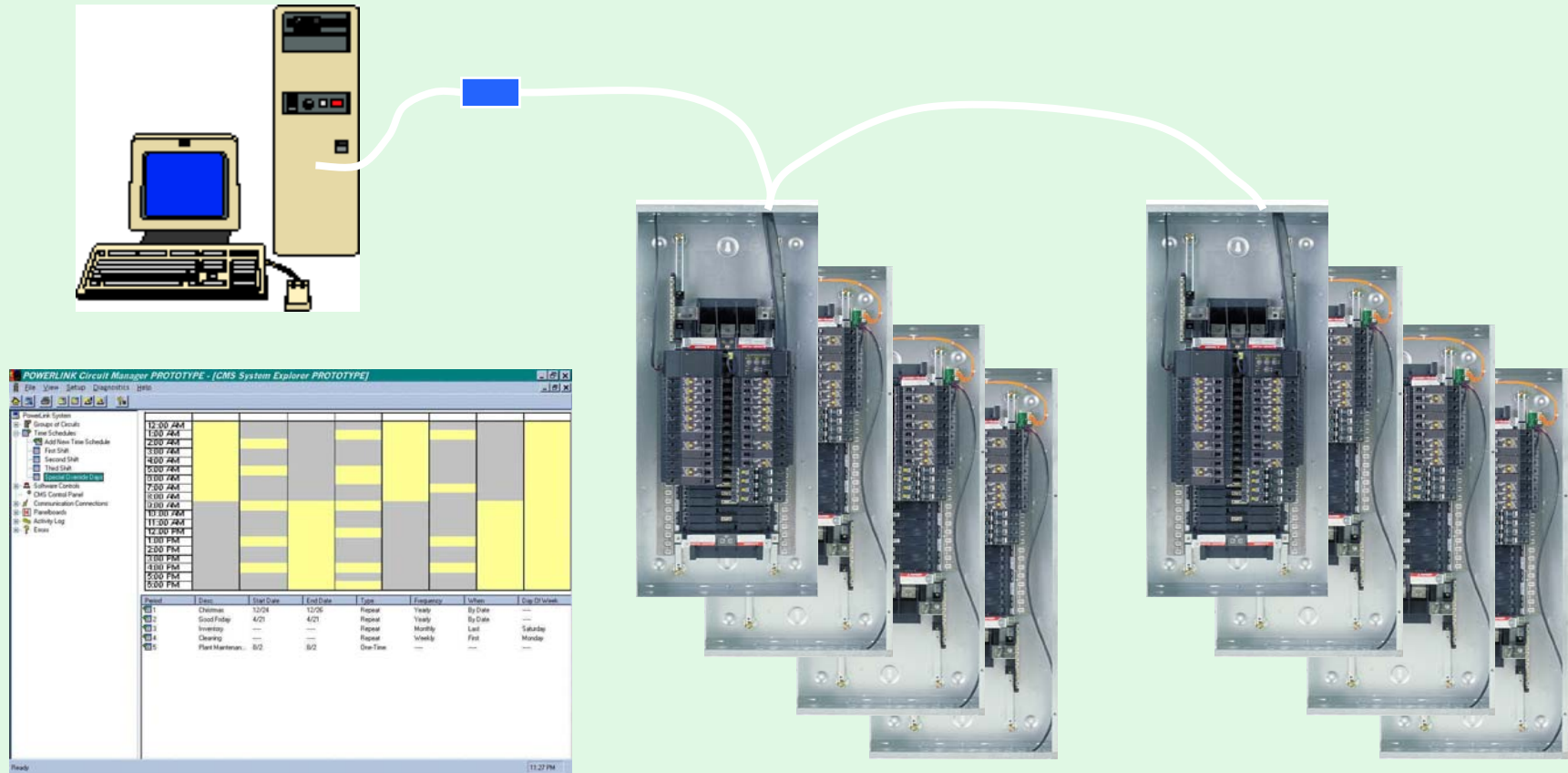
# NF500G3 Input Driven Control



# NF1000G3 Stand-Alone, Time-Based Control

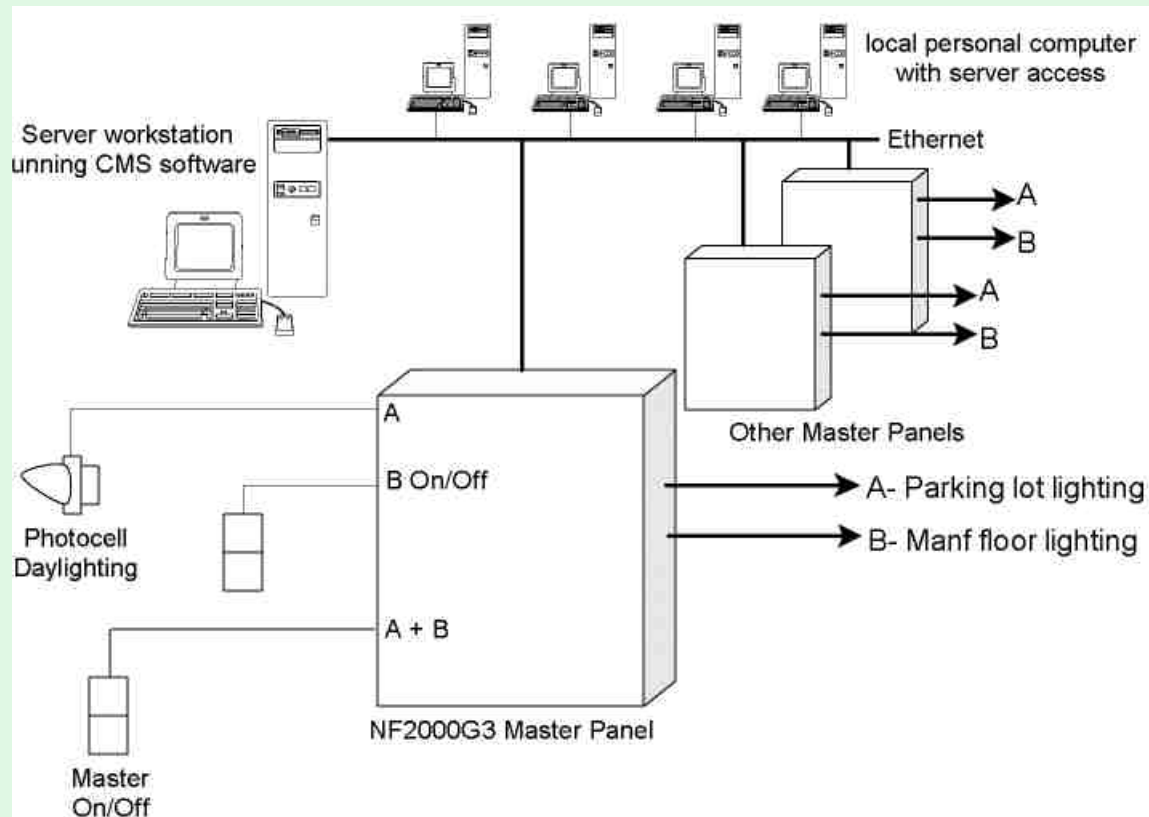


# RS485 Network Communications

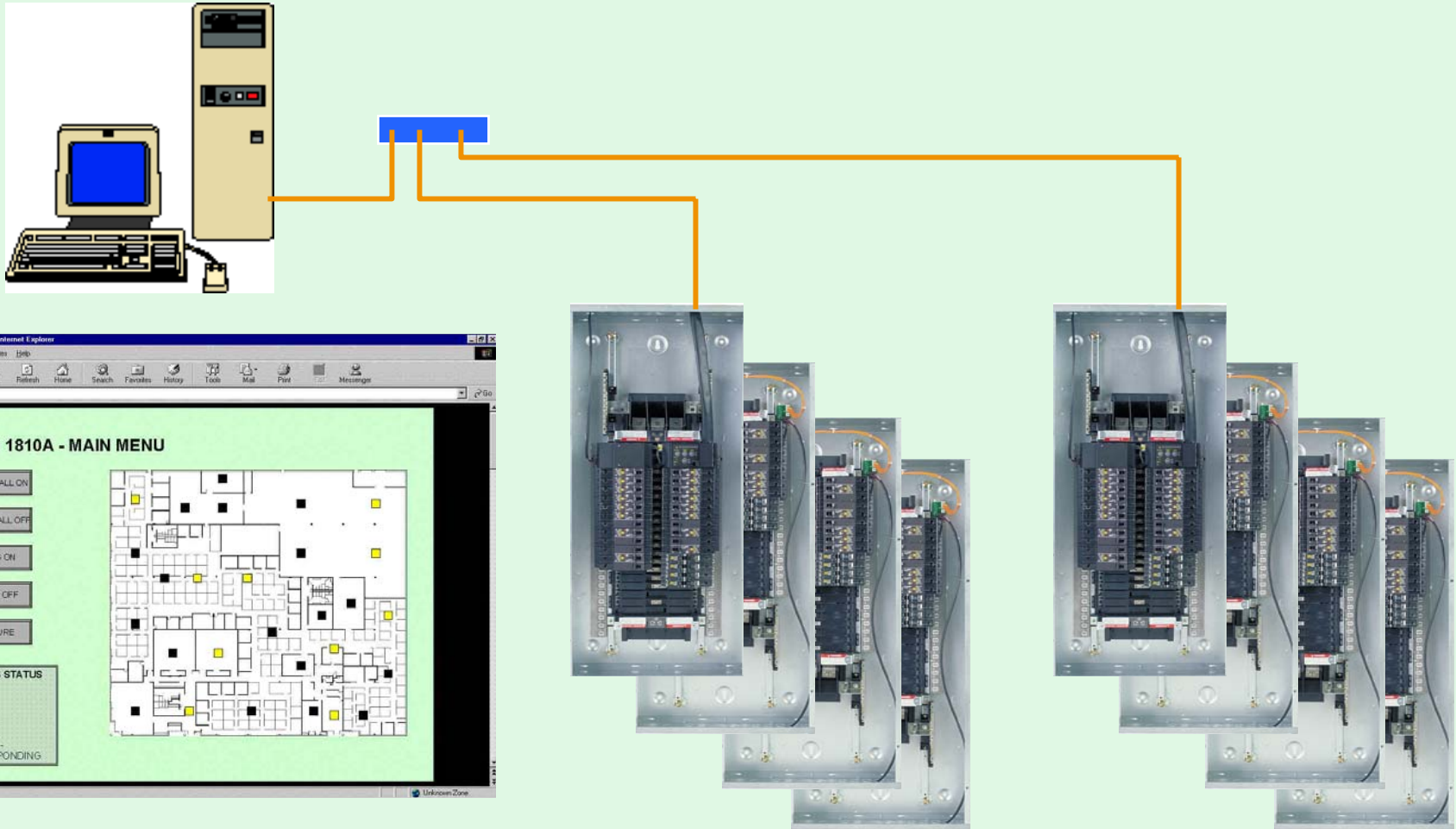




# NF2000G3 Comprehensive control/monitoring



# Ethernet Network Communications



# Web Enabled Features (to name a few...)

---

## Embedded Web Pages

- Breaker/Panelboard/System status
- Range of Graphical User Interfaces Available

## Email Notification

- Notification of non-responding breakers, busses, controllers, etc.
- Notification of runtime (based on time presets)

# Web Enabled Features

---

## Run-Time

- **Monitor breaker ON-Time**
- **Compares to setpoint for re-lamping notification (preventative maintenance)**

## Communication Loss Action

- **Separate timers for Ethernet and serial**
- **Use as part of an integrated control strategy (especially when not set to RUN)**

# New Features

---

## Time Synchronization

- **Controller can automatically sync clock to a Network Time Server**
- **Public or private servers; firewalls**
- **Windows XP**
- **Network Appliances available for “island” mode applications**

## Input Synchronization

- **Adds “soft-wiring” of control sources back to inputs**
- **You can automatically :**
  - Change the state of an input (sweep)
  - Enable/Disable an input (sales floor)
  - Enable/Disable an input timer (night overrides)

# New Features

---

## Event Log - saves last 512 events

- Schedule Object State (1 – 16)
- Input Object State (1 – 64)
- Zone State (1 – 64)
- Remote Source State (1 – 32)
- Remote Source Time-Out (1 – 32)
- Zone Override Enable (1 – 64)
- Zone Override Type (1 – 64)
- Override Time-Out Enable (1 – 64)
- Timer Inhibit (1 – 64)
- Input Inhibit (1 – 64)
- Latched Input State (1 – 64)
- Non-Responding Breaker State
- Breaker Present
- Bus Present
- Communications Time-out
- Halt Mode
- Front Panel Access
- Power Outage

# Field Commissioning and Support

---

- Design assistance
- Custom control layout/documentation
- Control wiring verification
- Equipment test
- Computer and software installation
- Programming to owners requirements
- Local training of operators



# Factory Support

---



- Technical Support Center staffed with trained engineers. Unlimited free service.
- Priority Technical Center remote access to customer's system. Provides program modifications, firmware and software upgrades. Toll free tech support number.



# Factory Subnet Testing



# Environmental Concerns

---

- Square D shares your concern for the environment.
- We manufacture products designed to provide comfort yet reduce power consumption and thereby reduce the amount of harmful emissions released to the environment.
- Our goal for 2004 is to ensure that 100% of our manufacturing units comply with ISO 14001.



---

**Thank you for your time and attention!**  
Questions and comments

John T Berry

1023 E Baltimore Pike

Media, PA

610-892-1676

[john.berry@us.schneider-electric.com](mailto:john.berry@us.schneider-electric.com)